REMARKS

The Pending Claims

Claims 1-5, 7, and 18-26 are pending and are directed to a flexible metal-clad laminate (claims 1-5, 7, and 19-25) and a flexible printed wiring board comprising the flexible metal-clad laminate (claims 18 and 26).

The Amendments to the Claims

Claim 1 has been amended to recite that the metal foil of the flexible metal-clad laminate is from 3 to 50 μm in thickness. Claim 1 also has been amended to recite that R^1 and R^2 of the condensation polymer unit represented by formula (1) are the same and each represents an alkyl group having 1 carbon atom, i.e., a methyl group. The amendments to claim 1 are supported by the specification at, for example, page 12, lines 14-16, wherein the favored metal foil thickness is described and page 41, synthesis example 1, wherein 3,3'-dimethyl-4,4'-biphenyldiisocyanate is used as one of the starting materials. Accordingly, no new matter has been added by way of these amendments.

Summary of Advisory Action

The Office has rejected claims 1-5, 7, and 18 under 35 U.S.C. § 103(a) as allegedly unpatentable over the combination of Ohmura et al. (U.S. Patent 4,377,652) and Akahoshi et al. (U.S. Patent 4,970,107). Additionally, the Office has rejected claims 1-5, 7, and 18-26 under 35 U.S.C. § 103(a) as allegedly unpatentable over Watanabe et al. (U.S. Patent 3,936,575) in view of Frost (U.S. Patent 3,984,375) and Akahoshi et al. (U.S. Patent 4,970,107). Reconsideration of these rejections is hereby requested.

Discussion of the Ohmura-based Rejections

Ohmura et al. discloses a polyamide-imide composition useful in electronics. However, Ohmura et al. does not teach or suggest a flexible metal-clad laminate obtained by the application of the specific polyamide-imide resin layer as recited in the Applicants' amended claims. Ohmura et al. simply discloses a genus of the species represented by formula (1) of the present invention. In that respect, Ohmura et al. discloses various structural formulae, with only one of these corresponding to the condensation polymer comprising the unit represented by formula (1) in claim 1 (namely, the polyamide-imide in which Ar' has the sub-structure listed in column 3, line 21). It would be exceptionally difficult for a person skilled in the art to focus on only this particular structural formula amongst the many disclosed by Ohmura et al. Furthermore, the sub-structural formula is

itself a genus, wherein each R may be the same or different and each may represent hydrogen, halogen, or a C_{1-4} alkyl group (column 3, lines 45-47). Further, Ohmura et al. teaches that the most preferred polyamide-imides are those in which the Ar' group is unsubstituted in the R position (column 4, line 60, through column 5 line 10), and the unsubstituted compounds are the only substrates used in the examples of Ohmura et al. Therefore, the structural formulae of Ohmura et al. do not teach the specific substituents and substitution positions reflected by formula (1) of claim 1 and the claims dependent thereon.

The present invention relates to a flexible metal-clad laminate, which is obtained by forming, on a 3 to 50 μm thick metal foil, a heat-resistant resin film layer composed of polyamide-imide comprising the specific unit of formula (1). The flexible metal-clad laminate of the invention demonstrates an excellent effect such that it shows no curling despite the thickness of the metal foil (only 3 to 50 μm). The structure disclosed in Ohmura et al., which is the closest to the flexible metal-clad laminate of the present invention, is that of Run No. 4 in Table 2, wherein a layer composed of polyamide-imide is formed on a copper plate (base material). A person skilled in the art would not envisage from the wording "plate" that the thickness thereof is as thin as 3 to 50 μm. Thus, Ohmura et al. does not teach applying the same to a metal foil of 3 to 50 μm thickness, but instead to something with a substantial thickness that can withstand the internal stresses of a drying resin. Therefore, Ohmura et al. does not intend to prevent curling of the laminate.

In contrast, by using the polyamide-imide resin with the structure represented by formula (1), the present invention solves the problem of curling occurring when the resin solution is applied to a specified thin metal foil, and the laminate is then dried. Claim 1 and the claims dependent thereon specify a radius of curvature, a coefficient of thermal expansion, and the average surface roughness so as to provide the effect of no curling.

In addition, with regard to the printed wiring board of the present invention as defined by claim 18 (which also is dependent on claim 1), Ohmura et al. discloses a method for preparing a multi-layer circuit board in column 12, lines 1-11. In view of the definition of the multi-layer circuit board in column 11, lines 4-7, the disclosure appears to suggest that the multi-layer circuit board is prepared by coating (or laminating a film of) a polyamide-imide composition over the entire surface of the circuit. Thus, the flexible metal-clad laminate of the present invention, wherein the circuit is not yet formed, is distinguishable from the multi-layer circuit board of Ohmura et al. involving a previously existing circuit.

The disclosure of Akahoshi et al. does not remedy the deficiencies of Ohmura et al. Specifically, Akahoshi et al. discloses rigid multi-layered wiring circuit boards with a surface roughened copper layer for improved adhesion to the resin. The inherent rigidity of the

printed circuit boards disclosed in Akahoshi makes them quite different than the flexible metal-clad laminate of claim 1 of the claims dependent thereon. Additionally, due to the rigid nature of the disclosed boards, Akahoshi et al. does not discuss the problem of laminate curling.

Accordingly, neither Ohmura et al. nor Akahoshi et al. discloses a flexible metal-clad laminate with the characteristics defined by claims 1-5, 7, and 18. These references also do not disclose the problem of, or a solution to, curling of the laminate. Additionally, the present invention is defined by limitations such as the insoluble content, radius of curvature, and dimensional change, none of which are disclosed in the above references. As a result, the cited references, even in combination, cannot be considered to render obvious the flexible metal-clad laminate of the pending claims. The obviousness rejection of claims 1-5, 7, and 18 based on the combination of Ohmura et al. and Akahushi et al. should be withdrawn.

Discussion of Watanabe-based Rejection

Watanabe et al. relates to a flexible metal-clad laminate; however, the resin disclosed is an epoxy derivative. Watanabe also discloses the process wherein a flexible metal-clad laminate for use in printed circuits is obtained by impregnating a fibrous base material to a copper foil by means of a roll-laminator (as described in column 1, lines 17-24). The roll-lamination process does not rely on direct application of the resin layer to a metal foil followed by drying of the laminate, and, therefore, laminate curling is not addressed in Watanabe et al.

Frost discloses a flexible polyamide-imide resin for use as a film for electrical insulation. However, Frost teaches the use of such resins as wire enamels and does not disclose flexible metal-clad laminates obtained by applying a polyamide-imine resin solution directly to a metal foil and drying the laminate. As such, Frost similarly does not address the issue of laminate curling.

As previously mentioned, Akahoshi et al. discloses a rigid multi-layered wiring circuit board with a surface roughened copper layer for improved adhesion to the resin. The inherent rigidity of the printed circuit boards disclosed in Akahoshi et al. makes them recognizably different than the flexible metal-clad laminate of the present invention. Additionally, due to the rigid nature of the disclosed boards, Akahoshi et al. does not discuss the problem of laminate curling.

Accordingly, neither Watanabe et al., Frost, nor Akahoshi et al. discloses the claimed flexible metal-clad laminate with the characteristics defined by claims 1-5, 7, and 18, or by claims 19-26. The roll-laminated epoxy resin disclosed in Watanabe et al. does not provide

the motivation nor the means to combine the disclosure of the Watanabe et al. reference with the disclosures of the Frost and Akahoshi et al. references. Moreover, none of these references discloses the problem of, or a solution to, curling of the laminate addressed by the Applicants by way of the present invention. As a result, the cited references, even in combination, cannot be considered to render obvious the flexible metal-clad laminate of the pending claims. The obviousness rejection of claims 1-5, 7, and 18-26 based on the combination of the Watanabe et al., Frost, and Akahoshi et al. references should be withdrawn.

Conclusion

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

John Kilyk, Jr., Reg. No. 30,763
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

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